EXAMINING THE PERFORMANCE OF GREEN SUPPLY CHAIN MANAGEMENT IN OIL INDUSTRY IN TANZANIA
A CASE STUDY OF TAZAMA PIPELINES LIMITED

BY
SPECIOZA MKAMI MAKIMA

Masters in Supply Chain Management
September, 2019
EXAMINING THE PERFORMANCE OF GREEN SUPPLY CHAIN MANAGEMENT IN OIL INDUSTRY IN TANZANIA

A CASE STUDY OF TAZAMA PIPELINES LIMITED

By
Specioza Mkami Makima
Reg. No. 04.9931.02.01.2017

A Dissertation Submitted in Partial/Fulfilment of the Requirements for the Award of Masters of Supply Chain Management (MSCM) of College of Business Education

Dar es Salaam
2019
DECLARATION

AND

COPYRIGHT

I, SPECIOZA M. MAKIMA, declare that this dissertation is my own original work and that it has not been presented and will not be presented to any other higher learning Institution for a similar or any other academic award.

Signed: _____________________  Date: ____________________

© 2019

This dissertation is copyright material protected under the Berne Convention, the Copyright and Neighbouring Right Act of 1999 and other international and national enactments, in that behalf, of intellectual property. It may not be reproduced by any means, in full or in part, except of short extracts in fair dealing, for research or private study, critical scholarly review or discourse with an acknowledgement, without the written permission of the Dean, School of Graduate Studies, on behalf of the author and the College of Business Education.
CERTIFICATION

I, the undersigned certify that she has read and hereby recommend for acceptance by the College of Business Education, a dissertation titled “Examining the Performance of Green Supply Chain Management in Oil Industry in Tanzania” in partial fulfilment of the requirements for the award of a degree of Masters in Supply Chain Management (MSCM) of the College of Business Education, Dar es Salaam Campus.

________________________________________
(Major Supervisor)

________________________________________
(Supervisor’s Signature)

Date ___________________________
DEDICATION

This dissertation is wholeheartedly dedicated to my beloved parents, Sisters Godriver, Consolatha and brothers Faustine, Elibarick and Jonas. They never left my side and are very special.

I dedicate this work to my Daughter Larraine for being there for my master’s programme, being my best cheerleader.

I also dedicate this dissertation to my bosses, colleagues and all workers of TAZAMA who supported me through the process. I will always appreciate all they have done to me.

“Thank you for being my mirror”.

iii
ACKNOWLEDGEMENT

I thank Almighty God for the way the created me and the blessing He is always raining onto me.

I would like to express my appreciation to my supervisor Dr. Nangawe A.G being a good moderator and mentor who gave me immense guidance and taught me working hard to pursue this goal.

I would like to thank and be grateful to Goodluck Fungo and Lorraine Ghati for going out all their way to facilitate collection of data. They are my ultimate role models.

Nobody has been more important to me in the persecution of this research than the member of my family, my mother and my wonderful soul and friend daughter Larraine, for the encouragement and support.

I would also like to extend my since gratitude to Patrick Mzava, Nassoro Mitimya and Deogratius Msemwa for giving me opportunity of making arrangements and obtaining special permits from TAZAMA when it was for me to attend my studies.
# TABLE OF CONTENTS

Declaration And Copyright ............................................................................................................. i
Certification ...................................................................................................................................... ii
Dedication ......................................................................................................................................... iii
Acknowledgement .......................................................................................................................... iv
List of tables ....................................................................................................................................... vii
List of figures ...................................................................................................................................... viii
Abbreviations ..................................................................................................................................... ix
Abstract ............................................................................................................................................... x

## CHAPTER ONE

INTRODUCTION ............................................................................................................................. 1
1.1 Background ................................................................................................................................. 1
1.2 Problem statement ....................................................................................................................... 15
1.3 Research Objectives .................................................................................................................. 16
1.4 Research Questions .................................................................................................................... 16
1.5 Significance of the study ............................................................................................................ 17
1.6 Scope of the study ...................................................................................................................... 18

## CHAPTER TWO

LITERATURE REVIEW .................................................................................................................. 19
2.1 Definition of Key Terms ............................................................................................................. 19
2.2 Theoretical Literature Review .................................................................................................. 21
2.3 Empirical Literature Review ..................................................................................................... 25
2.4 Conceptual framework .............................................................................................................. 34
LIST OF TABLES

Table 3.1: Distribution of Respondents in Departments ............................................. 38

Table 4.1 Job Experience of Respondents................................................................. 43

Table 4.2 Challenges which are contributed by Environmental Factor………………… 45

Table 4.3 Factors caused by TAZAMA Management................................................. 47

Table 4.4 Table of Representation of Vandalism on Green Supply of Oil Industry at TAZAMA.................................................................................................................... 48

Table 4.5 Efforts conducted by different Sectors to improve GSCM ....................... 50

Table 4.6 Suggestion on solving the challenge caused by Natural Factors ............... 52

Table 4.7 Suggestion to TAZAMA Management ......................................................... 53

Table 4.8 Diagram of suggested ways to overcome Vandalism............................... 54

Table 4.9 Initiative to improve Green Supply chain in Oil Industry at TAZAMA Pipelines Limited ................................................................................................................. 55
LIST OF FIGURES

Figure 2.1: Conceptual Framework................................................................. 34

Figure 4.1: Age Group ................................................................................. 41

Figure 4.2 Gender Group........................................................................... 42

Figure 4.3 Education Levels of Respondents............................................. 43
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPA</td>
<td>Environmental Protection Agency</td>
</tr>
<tr>
<td>EWURA</td>
<td>Energy, Water, Utility Regulatory Authority</td>
</tr>
<tr>
<td>GSC</td>
<td>Green Supply Chain</td>
</tr>
<tr>
<td>GSCM</td>
<td>Green Supply Chain Management</td>
</tr>
<tr>
<td>IBM</td>
<td>International Business Machine</td>
</tr>
<tr>
<td>LPG</td>
<td>Liquefied Petroleum Gas</td>
</tr>
<tr>
<td>MGCC</td>
<td>Mass Growth Capital Corporation</td>
</tr>
<tr>
<td>NBS</td>
<td>National Bureau of Statistics</td>
</tr>
<tr>
<td>NEMC</td>
<td>National Environment Management Council</td>
</tr>
<tr>
<td>NNPC</td>
<td>Nigerian National Petroleum Corporation</td>
</tr>
<tr>
<td>PIEA</td>
<td>Petroleum Institute of East Africa</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>Research and Development</td>
</tr>
<tr>
<td>SCM</td>
<td>Supply Chain Management</td>
</tr>
<tr>
<td>SMEs</td>
<td>Small and Medium Entrepreneurs</td>
</tr>
<tr>
<td>TAZAMA</td>
<td>Tanzania Zambia Mafuta</td>
</tr>
<tr>
<td>TPDC</td>
<td>Tanzania Petroleum Development Corporation</td>
</tr>
<tr>
<td>UNEP</td>
<td>United Nations of Environment Programme</td>
</tr>
<tr>
<td>USA</td>
<td>United States of America</td>
</tr>
<tr>
<td>WB</td>
<td>World Bank</td>
</tr>
</tbody>
</table>
ABSTRACT

This study established the impact of efficiency of Green Supply Chain Management in oil industry in Tanzania. The Global health and environmental legislations consciousness and standards are requiring compliance by manufacturers, retailers, traders and distributors to compelled and set by the practices throughout the Supply Chain Management.

In this study captured the green advantage that incorporating the green strategies into planning processed, by reducing costs on ensuring that the customers understand the benefit of being green.

Primary data was collected from the major crude oil transporter in Tanzania (TAZAMA pipelines Ltd) through questionnaires by using statistics.

The study showed that the crude oil industry have adopted the green supply chain to moderate the need of awareness to the concept. Also the study found out the positive impact on improving quality, productivity efficiency and cost savings.

The study recommended that, Tazama pipeline Limited, the government and private sectors should play its roles to improve efficiency on green supply chain of oil.
CHAPTER ONE

INTRODUCTION

1.1 Background

An increasing number of consumers and businesses are choosing safe and environmentally friendly products when making a purchase decision. In addition, global health and environmental legislations and standards are requiring compliance by manufacturers, retailers, brand managers, traders, and distributors. Diffusion of environmental practices throughout the supply chain has garnered significant attention over the past couple of decades (Sarkis, 2011). Initially, organizations focused on reactive internal initiatives to improve environment performance through the introduction of environmental management systems and compliance with regulations (Hoffman, 1999).

This internal focus on improvement of environmental operations and performance has started to shift to inter-organizational collaboration within the broader supply chain, as organizations increasingly realize that the savings from low-hanging fruit of internal environmental operations improvements have been increasingly harder to come by. Businesses all over the world are currently threatened by globalization of markets, short product life cycles, and need of lower costs and ever increasing demands of the customer. The environment, in particular, global warming, is attracting considerable attention today from the media, academics, analysts, and the business community. Companies are optimizing transportation operations and reducing their energy
consumption. They are exploring ways to recycle and reduce packaging in their products. The expansion of green consciousness globally makes the business case for green a compelling one.

Capturing the green advantage involves incorporating green strategies into planning, processes, products and promotions, reducing costs in some areas and improving materials and ingredients in others and making sure customers understand the benefits of being green (Green Supply Chain Forum, 2008) by (Carter, 2008), and (Walley, 2014).

Green Supply Chain Management (GSCM) evolved from supply chain management (SCM). The concept of SCM was introduced and popularized in the 1950s when manufacturers minimized the production costs through mass production (Hugue, 2007). As competition intensified in the 1990s, the increased awareness of green practices has triggered firms to act in an ethically and socially responsible manner in their supply chains. The GSCM concept is introduced by adding a “green” component into Supply Chain Management (SCM) to addressing the influences and relationships between SCM and natural environment (Feng, 2009). A green supply chain is therefore a series of activities and processes in the supply chain that strive to continually achieve environmentally friendly practices that are sustainable in the long run. Sustainability implies meeting the current needs without jeopardizing the ability of future generations to meet theirs and involves responsible use of resources so that they can be replenished in a natural equilibrium where by many tradeoff decisions are made in green supply
chain optimization with the goal being maximizing carbon emission reduction (Feng, 2009).

The environmental concerns such as toxic waste should be addressed together with SCM and considered as an important element in production processes for industrial growth (Sheu, 2005). In fact, businesses are operated in several interrelated pressures from different parties such as shareholder, society, governments, customer, market and business organization when respond to environmental matters such as conserving materials, reduced water and energy use. Environmental and social issues have become more and more important in managing any businesses during the rapid changes, particularly in global manufacturing scenarios (Amemba, 2013). Firms are pressurized to implement GSCM practices in their operations in order to achieve a balanced growth in terms of economic, environmental and social without destroying the environment.

The Green Supply Chain practices in procurement are Firstly, there is green purchasing involving sourcing for materials that are environmentally friendly with less impact on environment and can be recycled or be disposed of easily (Feng, 2009). By incorporating green principles into purchasing, companies can provide design specifications to suppliers that include environmental requirements for green purchased items. This assists in deciding which suppliers to collaborate with for materials, equipment, parts, and services that support environmental goals (Hu, 2010).
Secondly, there’s green production that focuses upon three fundamental goals; minimizing emissions, effluents and accidents, minimizing the use of virgin materials and non-renewable forms of energy, and minimizing the life-cycle cost (cradle to grave) of products or services (Hart, 1992).

Thirdly, Green supply chain also involves green transportation and storage by ensuring minimum storage costs are used, that are also environmental friendly in terms of using a transport system that is not contributing to global warming through emission of pollutants (Feng, 2009).

Lastly, green packaging which include the use of packaging material that is environmentally friendly and cost efficient. The end user should also ensure minimal greenhouse gas emissions and use of the final product in an environmental friendly manner. Green packaging requirements involves use of less material that is non-polluting, recyclable and reusable (Feng, 2009).

The Supply chain in the oil industry comprises of activities like exploration, production, oil refining, marketing and consumption (Chima, 2007). These activities in the oil industry represent the dependence between companies and the materials flowing through the chain, like exploration includes seismic, geophysical and geological operations, while production operations include drilling reservoir, production and facilities engineering while refining is a complex operation whose output is the input for
marketing that includes sale of oil and other refined products. Each stage of the link can be a separate company or a unit of an integrated firm. The major and common issue along the links in oil industry is economics; weighing benefits versus costs along the chain (Chima, 2007). For a green supply chain to be effective and positively impact on performance, these linkages must be managed as an integrated unit.

The United States Environmental Protection Agency (EPA) issued a guide entitled ‘The Lean and Green Supply Chain: A Practical Guide for Materials Managers and Supply Chain Managers to Reduce Costs and Improve Environmental Performance” (McDaniel, 2000). This guide provides a systematic approach to implementing a green Supply Chain. The proposed model is created through a collaboration program with US industry, trade associations, research institution, and government agencies.

In a manufacturing process, the company can apply green by several methods to reduce the energy and resource consumption. This is where reuse and recycling are referred. The Chinese sugar refinery and Indian paper firm case studies brilliantly apply the green ‘3R’s principle of Reduce, Reuse and Recycle, with both firms diversified into related industries like sugar, paper, alcohol, cement and ethanol and utilize the waste products of other industries as raw material or for power generation. For example, in a Chinese sugar manufacturer, Guitang Group can reduce the wastes and improve their financial performance by using waste from the upstream as raw materials for downstream production integrating green supply chain management into an embryonic eco-industry development (Zhu, 2004).
According to the Special Committee on the Review of Petroleum Products Supply Distribution set up by the NNPC in Nigeria they posited that. The storage infrastructure consisting of 22 loading depots linked by pipeline of various diameters has aggregate installed capacities of 1,266,890 (PMS), 676,400 (DPK), 1,007,900 (AGO), and 74,000 (ATK) m³ tonnes, nation has 5,120 kilometers of products and crude pipelines, 21 storage depots and one petroleum products import terminal at Atlas Cove, Lagos. Between 2010 and 2012, total of 2,787 lines breaks were reported on pipelines belonging to the Nigerian National Petroleum Corporation (NNPC), resulting in a loss of 157.81 mt of petroleum products worth about ₦12.53 billion and further stated that the bulk of these incidents occurred in the Southern half of the country where the difficult terrain of the Creeks and Coastlines apparently makes such activities easy¹. This illegality has been so systematized in such a manner that it goes with a semblance of a franchise, wherein even public officials have been implicated. It is evident from the above citation that oil pipeline vandalism is a bourgeoning organized crime in Nigeria and the frequency of such attacks has been disturbing in recent times, (Ekenedirichukwu, 2010).

Environmental issues under legislation and directives from customers are an important concern in the oil industry in Kenya. To survey current green activities in the petroleum marketing firms in Kenya, 29 firms will be studied to provide an in depth interview on

---

green procurement, green manufacturing and remanufacturing, green distribution, waste management and reverse logistics.

In Tanzania, Energy and Water Utilities Regulatory Authority together with other government, sartorial and professional bodies responsible for environment issues are still struggling to compel the firms, especially in oil industry to adapt the environmental friendly Supply Chain Management (Melyoki, 2017).

Tanzania is one of the importer of petroleum products where by petroleum products supply in Tanzania is conducted through a bulk procurement System since 2011. Under Bulk Procurement System the petroleum products are procured from selected suppliers through competitive bidding and import them to be transported through pipeline and trucks within and outside Tanzania. Tanzania Petroleum Development Corporation (TPDC) was established by the government under Ministry of energy and minerals to implement petroleum exploration, transportation and development of policies (Melyoki, 2017).

TAZAMA pipelines limited was incorporated in 1968 and is owned by the government of republic of Zambia with 67.7% share capital and the government of republic of Tanzania with 33.3% share capital. The company was formed with the purpose of transporting crude oil or its petroleum products from the port of Dar es Salaam into
landlocked Zambia. The port starts from the port of Dar es Salaam to Indeni refinery in Ndola covering the total distance of 1,710 km.\(^2\)

However, the biggest oil transporter, TAZAMA has tried hardly to adopt the mechanism for its own business competitive reasons while keep the environment safe (chinambu, 2011).

TAZAMA PIPELINES LTD is the company that owns the pipeline which used to transport crude oil from mooring Dar es Salaam Tanzania to the refinery to Ndola Zambia that covers the length of 1740Km. There is a convention centered between Tanzania and Zambia. Tanzania own one third and two third owned by Zambia. To assist the flow rate of crude oil TAZAMA PIPELINES LTD have five pumping stations in Tanzania sides and two pumping station in Zambia it aims to facilitate the availability of fuel in Zambia, help to operate and maintenance of crude oil and transport crude oil from Dar es Salaam to Ndola, (Chinambu, 2011).

In assuring green supply chain TAZAMA pipeline Limited is performing the following efforts while transferring oil so that make sure there is no pollution, the line status is good Weak or corroded area of the pipeline are changed immediately so as to avoid leakage that can affect the environment like destroying water bodies, soil fertility and increase carbonic acid, providing training on safety to people who live around the pipeline area, put markers and warning signs that showing the pipeline is there so to alert

\(^2\)PIPELINE news, volume 1 issue 4, 1998
people that there should be no any further activities that can be conducted to avoid accident also day to day inspections insure that the pipeline is safe no leakages.\(^3\)

Comprehensive programs for facilitating diagnostic technical upgrades, construction and major repairs to be developed like using intelligent pig brush is the material that used to detect the thick and weak area inside the line. This material was introduced in 2013 so as to help improving the Cathodic protection of outside the pipe also this is the system for detecting irregularities and complex monitoring vulnerable points and play an important role in protecting the pipeline TAZAMA pipelines Ltd buying the pre-coated pipes instead of bare pipes which has Cathodic protection the method of controlling corrosion by using a direct electrical current which neutralize external corrosion on a pipe which can result on environmental and air pollution 2017 there were 20 numbers of leaks and after starting using these pipes during 2018 there were only 9 leaks (bursts)\(^4\).

Another effort by TAZAMA pipeline is to ensure the effective repair and maintenance TAZAMA pipelines are closed for 30 days every Year to enable INDENI refinery to operate effectively and also to detect defaults that can affect environment at large, they also schedule another 10 days for unscheduled pipeline or Refinery shut down. At TAZAMA pipeline repairs was conducted out in 2013 for the sake to establish the extent of corrosion in the pipeline so as to help improving reliability and reduce losses due to leaks. Whereby most of pipes have been replaced so as to avoid environmental pollution.

\(^3\) TAZAMA pipeline, The guardian, October 2007
\(^4\) TAZAMA news, issue 10 vol 1, 2019
Improvement of support facilities such as telecommunications, instrumentations, Cathodic protection and IT has been carried out simultaneously to ensure that operation of pipeline is being improved accordingly that can be more effective and active just in case there is any leakage or accident that might occur during the transportation of oil. TAZAMA has got Emergency Oil spill response Equipment which are stationed at Dar es Salaam Terminal office and Iringa Pump station in Tanzania and at Kalonje Pumping station in Zambia.

Another effort conducted by TAZAMA pipelines ltd is that they have been carrying out clean-up and restoration works on all polluted areas whenever there was spillage, and also vegetation plants and other infrastructures which are normally affected by pollution have been always being compensated by TAZAMA after the assessment by the Agricultural officers from the Ministry in the presence of village Administration.5

Also Tanzania government have conducted several efforts to influence Green supply chain in oil industry whereby there is a specific government policy on all environmental matters including concerns associated with energy operations in Tanzania that the policy focuses on ensuring sound practices and proper management of the environment. It contains a section that touches on environmental concerns in economic activities, which include mining and gas/oil exploration, production, transferring and marketing operations. The policy requires these operations to be carried out in a way that

5TAZAMA pipeline, issue 6 volume 3, 2015
effectively minimizes risks to the environment. It also emphasizes appropriate and safe
disposal of hazardous wastes and emission produced by oil and gas activities\(^6\).

The National Environmental Policy outlines mechanisms aimed at ensuring sound
environmental practices are maintained. These mechanisms include regular audits and
the requirement to undertake Environmental Impact Assessment during the planning
state of prospective activity. The policy encourages the use of retorts that serve to
encourage the exploration of shale oil. It also provides for economic principles that
encourage efficient environmental management of natural resources, such as adoption of
the "polluter pays" principle, \(^7\)

Another effort of Tanzanian government against vandalism is to establish Economic
Sabotage Act 1983 the Tanzania government has included vandalism and theft as one of
economic sabotage cases where by it has contributed a lot on decreasing leakages where
by economic sabotage cases may lead to life sentence in jail. Also by using village
government especially to those areas where TAZAMA pipeline passed they provide
training on how to protect them from accidents that may be caused by leakages or any
eruption that might occur. \(^8\)

Despite the efforts of TAZAMA pipelines limited and the Tanzania government like
establishing economic sabotage act 1983, establishment of national conservation policy,

\(^{6}\text{National Environmental Policy 1997 Tanzania Government.}\)
\(^{7}\text{National Environmental Policy 1997 Tanzania Government.}\)
\(^{8}\text{TAZAMA pipeline magazine, issue 4 volume 3, 2016}\)
increasing security on dangerous areas that pipeline has passed like Mbagala, Chalinze. Makambako near peoples settlements, planting trees and training to societies along the TAZAMA pipelines but still there are many environmental cases that are caused by eruption or leakage of oil pipeline that bring about a lot of consequences to environment. These leakages tend to loss of biodiversity which kills soil fertility, destruction of water bodies and killing living organisms in the water body.

Leakage is caused by external and internal activities or operation where by externally most of the people try to steal oil from the pump by piercing where they cause the leakage of oil that may lead to environmental destructions, water pollution and air pollution and sometimes death due to the high pressure of the oil in the pump that caused by bursting also fire eruption9.

Vandalism is one of the act by many people who live near TAZAMA pipeline that people are stealing the crude oil by piercing the pipeline by using the machine when used can produce withers which if come into contact with crude oil can result to fire eruption and burn large number of people. There was a major leak occurred on section 12/1 at Chalinze km114 was destroyed and also polluted 5km range of the seasonal river.

---

9TAZAMA pipeline magazine, issue 4 volume 3, 2016
Procuring crude oil with high density which exceed the range of 0.75 - 0.819 specific gravity, this hinder the engine operation and lead to engine breakdown, caused by high density of crude oil that sometime can lead to engine failure pipe can burst and caused larger damage to the environment like what occurred in 2016 at Melela village a major pipeline leak occurred at 201 km and polluted 600 metres of vegetation. This causes the death of people, air pollution and fire eruption 10.

TAZAMA pipelines limited incur the challenges of cost like high maintenance cost these are cost that are incurred on maintaining the machines like engines, cost of purchasing maintenance spare parts, high repairing cost whereby in order to reduce the impact on environment, cost of inspection there is usual inspection of pipelines to check whether there leakages or any default on pipes also cost of replacing the damaged pipes which is high especially when there are several destructions of pipeline done by people, weather or acidic nature of soil or minerals, Monitoring on the external surface of pipeline is also easier compared to the internal pipe, thus require a continuous monitoring and specific tools for inspection which are expensive.11

Weather conditions is among of the factors that cause fractures on the pipes that cause leakages which can affect the environment like temperature ranging from 20°C to 37°C with the maximum exposure time can cause corrosion as well as coating and fractures that result to leakages on environment parameter so that temperature and time plays a

10 TAZAMA pipelines news, issue10, 2017
11 TAZAMA pipelines news, issue10 volume 4, 2011
role in the corrosion process. Especially in coastal areas like Dar es Salaam whereby due to high temperature 20°C to 37°C which weakens the wrapping materials and the pipe can easily burst and affect the environment, in 2013 at Idetelo village, a pipeline reported at 621 km which polluted river downstream about 6 km and 300 metres of the vegetation also in 2007\textsuperscript{12}

Soil that containing large concentration of soluble salts in the form sulphates, chlorides, porosity or aeration, electrical conductivity or resistivity, moisture and pH are the most corrosive soils pipes are often designed in metallic or cementations pipe based on hydraulic capabilities rather than to consider the corrosion resistance so due to the presence of aggressive sulfide and chloride ions within the soil can then attack the metal surface, (Bertolin, 2013)

Areas like in 2013 Dar es Salaam city at Mbagala area km 32 from Kigamboni Pump station where by soil is salted where it requires more attention and supervision due to the fact that pipe are corroded at large extent which cause leakage and through this has caused loss of soil fertility and biodiversity at Mbagala-Charambe whereby no cultivation or plantation activities can occur. Also In 2000 a major leak on tank T4 at tank farm, Kigamboni occurred and about 900 kilometres of vegetation were polluted which was caused by salt that affected the stands of the tank and cause its collapse.\textsuperscript{13}

The next provides details about problem statement of the study.

\textsuperscript{12}TAZAMA pipelines news , issue10 volume 4, 2017
\textsuperscript{13}TAZAMA pipelines news , issue10 volume 4, 2017
1.2 Problem statement

Effective supply chain management practices in the petroleum industry includes maintaining continuous supplies of crude oil, the reduction of lead times, and lowering of production and distribution costs and green supply chain by conducting the oil supply chain which is environmental friendly that does not cause air pollution, soil pollution and water pollution. Green Supply Chain Management in oil industry has been proposed as a novel managerial action upon which firms are enabled to create sustainability in their manufacturing activities by minimizing environmental impact like reducing waste materials, air and water emissions and enhancing ecological efficiency, (Chimbati, 2010)

Despite the effort of the government by providing National environment policy and including vandalism as one of economic sabotage cases also TAZAMA pipeline limited efforts like inspection, using computerized systems, providing training to people living near pipeline areas and regular inspection, repairing, maintenance and monitoring Pipeline operations but still Green supply chain of oil by TAZAMA pipelines is not efficient because of leakages, pipeline bursting and fire eruptions that are still happening that caused by vandalism, procuring high velocity of crude oil that cause machine breakdown and bursting of pipes, the effect of temperature and acidic soil which results on loss of biodiversity, destruction of water bodies especially water resources, destruction of vegetation, air pollution, loss of soil fertility that hinder farmers to grow crops and water pollution that kills living organism in water bodies like Ruaha river.
This study assess the performance of Green Supply Chain in oil industry in Tanzania and suggest best ways to be applied so as to improve the efficiency of Green Supply Chain in oil industry in Tanzania and taking TAZAMA Pipelines as a case study.

1.3 Research Objectives

1.3.1 General Objective

To examine the efficiency of green supply chain management in oil industry in Tanzania

1.3.2 Specific Objectives

i. To determine the challenges of the green supply chain management that hinders the performance of TAZAMA Pipelines Limited

ii. To examine the initiatives towards improving green supply chain management of TAZAMA pipelines.

iii. To identify alternative solution to the challenges facing the green supply chain management practices so as to revamp its performance in TAZAMA Pipelines Limited.

1.4 Research Questions

The research addresses the following research questions:

i. What are the challenges of green supply chain that hinder performance of TAZAMA Pipelines Limited.

ii. What are the initiatives of various actors towards improving green supply chain of oil at TAZAMA Pipelines Limited.
iii. How can we eradicate the challenges facing the green supply chain management of TAZAMA Pipelines Limited?

1.5 Significance of the study

In future, implementing a green supply chain will be even more important than it is today. Reasons for this, center around more government regulations, increased awareness for environmental concerns, and a push from customers to be more sustainable. Greening the supply chain is not optional, it’s becoming the standard.

The petroleum companies will learn GSCM as a critical business function in assessing and evaluating both economic and ecological benefits associated with its adoption. They will also obtain information on the pressures, practices and how adoption of GSCM influences performance. Information on GSCM adoption constraints will be obtained and strategies to solve such problems sought in Tanzania and other similar organizations in the world.

The government is regulating environmental policies in the oil industry through the Energy and Water Utilities Regulatory Authority (EWURA) and National Environmental Management Authorities. The results from this study can act as the source of information in which the government policies on GSCM can be accessed and used in other companies in the country.

The area of GSCM is relatively young and is still suffering from a shortage of information. This research will help to bring forth unknown information in the oil
industry that will go a long way in facilitating further understanding of GSCM practices adoption. Future researchers will empirically test the relationships suggested in this paper in different countries, to enable comparative studies. A larger sample would also allow detailed cross-sectorial comparisons which are not possible in the context of this study.

Finally, the study help strategic investors who provide funding for GSCM in their organizations to better understand the exposure and best opportunity to invest their money.

1.6 Scope of the study

This study focused on matters concerning the practice and performance of Green Supply Chain Management in Oil Industry in Tanzania but with more focus on TAZAMA Pipelines Limited based in Dar es Salaam. TAZAMA Pipelines Limited is chosen because it is mostly likely to give a depicted picture on the issue of practices and performance of Green Supply Chain Management derived from its competitive position among the oil transporters in the region.

The study also used existing literature, data collected by other researchers and multilateral oil transporting firms, journals and reports provided by the National Bureau of Statistics (NBS) and relevant sectorial, government and professional bodies. The chapter covers the literature review of the study.
CHAPTER TWO

LITERATURE REVIEW

2.1 Definition of Key Terms

2.1.1 Green Supply Chain Management

The concept of green supply chain was first arisen by the Michigan State University in 1996 during an "environmentally responsible manufacturing" research. It was proved to be an effective way of management by the scholars in Michigan State University. After they found the establishment of green supply chain management in these enterprises such as IBM effectively solved the conflict between economic interests of environmental protection, so people admire it (Grant, 2012).

Green supply chain originates from the idea of supply chain management and sustainable development theory. It is a new subject; people have not studied it deep enough. Until now, there is still no unified, clear, authoritative definition. Generally speaking, it is a green system combines by the suppliers, manufacturers, distributors, retailers, consumers, environment, rules and cultural element. It is also the combination of logistics, information flow, cash flow, knowledge flow. Generally speaking, green supply chain management is a supply chain that guided by the sustainable development theories. The purpose of it is to achieve the goal of improving welfare, achieve compatibility with the environment and material optimization by improves the speed, certainty and other related channel (Chimbati, 2010).
2.1.2 Performance

The term of performance has a Latin origin, where the verb perform are had the meaning of English language, from the verb to perform, which signifies the regular accomplishment of a thing that requires ability or a certain skill. The noun performance denotes the manner of achieving the objectives predetermined by an entity.

Performance is understood as achievement of the organization in relation with its set goals. It includes outcomes achieved, or accomplished through contribution of individuals or teams to the organization's strategic goals. The term performance encompasses economic as well as behavioral outcomes. Brumbach views performance more comprehensively by encompassing both behaviors and results. He is of the view that behaviors as outcomes in their own right', which can be judged apart from results. Performance is an impact.\textsuperscript{14}

2.1.3 Green Purchasing

Green purchasing refers to the practice of cooperating with suppliers to develop products that are environmentally sustainable (Sarkis et al., 2008). According to(Lee, 2008), a buying organization with a GSCM initiative will pay attention to green practices of their suppliers by deploying collaboration-based activities that include training, environmental information sharing and joint research. Other organizations may opt for a less collaborative approach by merely demanding that their suppliers make use of environmental systems such as ISO 14001. External motivators, particularly customer

\textsuperscript{14}http://www.pondiuni.edu.in/storage/dde/downloads/hrmii_pm.pdf
pressure, are key drivers of the adoption of ISO 14001 (Vanchon, 2012). Other aspects of green purchasing include the facilitation of recycling, reuse and resource reduction (Diabat, 2011)

2.2 Theoretical Literature Review

2.2.1 Resource Dependency Theory

Theory According to resource dependence theory (RDT), firms seek to reduce uncertainty and manage dependence by purposely structuring their exchange relationships, establishing formal and semiformal linkages with other firms. Through interdependence, firms can synergistically combine their own resource sets with the complementary resources of their partners and thus develop a resource bundle that is unique and hard to imitate. By cultivating such relationship-specific capabilities that become superior to what the organizations may possess on their own firms can obtain sustainable competitive advantage and improved procurement performance (Lee, 2012). In this aspect, RDT is a relevant theory to SCM because it can help elaborate organization-environment boundary spanning activities, implying that a single firm can hardly achieve sustainable growth. Therefore, firms need to depend on the buyer-supplier relationship which helps improve cooperation and coordination among supply chain members (Dyer et al., 2000). For SCM to be strategic in nature, it is imperative that buyer firms adopt strategic initiatives, that is, implementation of GSCM practices that foster an effective relationship to provide mutual benefits (Lee, 2012).In the context of GSCM, inter-organizational collaboration is even more important for managing the
internal and external coordination and cooperation to have the system successfully implemented throughout the whole supply chains developed a decision model to measure environmental practice of suppliers using a multi-attribute utility theory approach. This theory will help in procuring of crude oil that happen to be one of the main reason in causing machine breakdown, bursting and leakage of the pipes due to high pressure and temperature interference (Zhu et al., 2011)

2.2.2 Theory of Sustainability

Kainuma (2006) proposed the multiple attribute utility theory method for assessing a supply chain including reuse and recycling throughout the life cycle of products and services. Sustainability Theory Sustainability means meeting the needs of the current generations without compromising the ability of future generations to meet theirs. It seeks to promote appropriate development in order to alleviate poverty while still preserving the ecological health of the landscape. Sustainability Malaba, Ogolla and Mburu Licensed under Creative Common Page 6 works to understand the connections between environment, economy and the society. In 2000, the World Bank published The Quality of Growth, advocating a broadening of the growth framework to a complementary agenda involves key quality aspects in the structural, human, social, and environmental dimensions of sustained growth, emphasizing a more equitable investment in people, and the need to sustain natural capital, dealing with global financial risks, improving governance and controlling corruption\textsuperscript{15}. According to a research report from the Economist Intelligence Unit by ExxonMobil on year 2011,

\textsuperscript{15}The World Business Council for Sustainable Development Report (WBCSD)(2005
there is growing importance of corporate sustainability in enabling companies to compete and to attract customers. Business both impacts and relies on the availability and health of our natural resources. In recognizing this connection and protecting wildlife habitat and biodiversity in and around their operations the survey claims that the adoption of sustainable practices does not cause companies’ share prices to rise. It could be that companies with a strong financial performance simply have more resources to devote to sustainability. What the findings do show, however, is that it is possible to take a proactive position on social and environmental issues while still delivering robust financial growth.  

Understanding the full life cycle of their operations is important to operating in an environmentally sustainable manner and involves four key steps: Assessing the surroundings; Designing the facilities and operations; Operating with integrity and Restoring the environment.

2.2.3 Ethics Theory

Ethics is a branch of philosophy that seeks to define what is right and what is wrong. It helps us understand what actions are wrong and why they are wrong. Across the world, not all cultures share the same ethical commitments, and cultural relativism acknowledges that. It is ideal that laws of a particular nation match their ethical commitment; even though some laws are changed to meet the ethical commitments, in most cases one may find that what is ethically right, sometime lacks legal backing. But in such cases, it is only strong personal ethical commitment that can help guide

\(^{16}\text{report from the Economist Intelligence Unit by ExxonMobil on year 2011}\)
behaviour. Even where there is strong personal ethical commitment, there are also cases of conflicting ethical positions. There are various philosophical approaches to environmental ethics, but only three will be discussed here; anthropocentrism, biocentrism and egocentrism. Anthropocentrism or human centred ethics is the view that all environmental responsibility is derived from human interests alone. It assumes that only human beings are morally significant and have direct moral standing. Since the environment is crucial to human well-being and survival, there is a duty towards the environment; a duty derived from human interest. Biocentrism is a life centred moral responsibility. According to the broadest version of biocentrism theory, all forms of life have an inherent right to exist. Egocentrism maintains that the environment deserves direct moral consideration and not consideration that is merely derived from human or animal interests. It suggests that the environment has a moral worth (Desjardin, 2008).

There are three main sources of rules that regulate behaviour of individuals and businesses; the law, non – legal rules and regulations and ethics. If a business is breaking the law, by not complying with one of the many environmental laws requirements. The business would want to move from that point of counter compliance, especially to the thieves who tend to steal oil and the government which has to generate the strong laws and by laws to help TAZAMA limited to operate smoothly.
2.3 Empirical Literature Review

2.3.1 Initiatives that of various actors towards improving GSCM on pipeline transportation.

The oil industry in Kenya witnessed significant government participation before the industry was liberalized in 1994. Consequently, the role of the private sector was minimal. The National Oil Corporation, incorporated in 1981 under the companies act (Cap. 486), was mandated to supply as much as 30% of the crude oil required in Kenya and coordinate activities towards oil exploration on behalf of the government. The sector boasts of over 30 oil importing and marketing companies comprising of five major companies namely Shell, Total, Kenol/Kobil, and Oil Libya. Chevron and the government owned National Oil Corporation of Kenya (NOCK). It also helped in procuring the best quality crude oil so as to avoid consequences that might be faced by the transporters especially pipeline transport (Njau, 2010).

In 2006, the Energy Act No. 12 of 2006 was enacted which created the Energy Regulatory Commission (ERC) mandated to regulate petroleum and renewable energy sectors in addition to electricity. The functions of ERC included regulating the importation, exportation, transportation, refining, storage and sale of petroleum and petroleum products. All petroleum operators and products are required to comply with provisions for environment health and safety.17

2.3.2 GSCM practices that can be adopted by oil industry

The issue of greening supply chains is critical for the successful implementation of industrial ecosystems and industrial ecology. Zhu & Cote (2004) suggest that, GSCM practices consist of four major dimensions: internal environmental management, external environmental management, investment recovery, and eco design.

Organizations have a number of reasons for implementing these green supply chain policies, from reactive regulatory reasons, to proactive strategic and competitive advantage reasons. Oil marketers may choose environmental strategies to guide them on how to respond to internal and external or anticipated competition. Thus the oil firms according to their own strategic orientations make decisions whether to include environmental factors into the overall process of strategy formation. Consequently the firm’s environmental culture represents one of the most important determinants in the definition of the environmental strategies, which depends on the firm’s history, the fields where it operates and the country in which it has its plants (Zhu& Cote, 2004).

For an organization to improve its environmental performance its internal environment performance is critical and this can only be achieved through quality management which ensure adherence to rigorous quality control by learning from experiences of their quality management programs (Sarkis et al., 2008) By receiving the certificate for the ISO 14001 environmental management system (EMS) standard, organizations are able to create structured mechanisms for continuous improvement in environmental performance. GSCM and logistics efforts have encouraged firms to adapt the closed-loop supply chain; Closed-loop supply chain management stands for “the design, control
and operation of a system to maximize value creation over the entire life-cycle of a product with the dynamic recovery of value from different types and volumes of returns over time (Rha, 2010).

GSCM practices should include working collaboratively with suppliers on green product designs, holding awareness seminars, helping suppliers establish their own environmental programs and so on. (Sarkis et al., 2008) describes a number of GSCM practices implemented by Chinese enterprises to improve their performance. Internal environmental management is a key to improving enterprise performance in terms of senior manager commitment and cross-functional cooperation. Commitment of senior managers is extremely conducive to the implementation and adoption stages for GSCM, because without such upper management commitment most programs are bound to fail.

Green initiative in a supply chain considers the use of environmental friendly inputs and transforming the inputs into by products that can improve the environmental condition in a supply chain. In the UAE 40% of companies knew the cost benefits of GSC in relation to the environment, 60% were ignorant or planned to adopt the practice in the future. Big companies often do not know the effects of their operations on the environment and are unaware of the fact that the modes of transport they use to transport their products which may be trucks, ships, planes or trains might be harming the environment. One of the methods to avoid this may be to use low emissions modes (Rettab, 2008).
2.3.3 Challenges of GSCM practices in oil industry based on pipeline transportation.

Sarkis et al., (2008) they mentioned three barriers in integrating GSC maintaining close relationships with their main suppliers, obtaining a larger market share through competition with other domestic sugar refineries by improving product quality and reducing costs, and ensuring the sustainability of their operations including reducing the environmental impacts. At the same time, there are some research studied barriers of applying GSCM from supplier’s perspective.

(Walley & Whitehead, 2014) conducted a qualitative study on the suppliers’ barriers of GSCM implementation for environmental-friendly image products like the Body Shop International. He realized that existing investments, information systems and habits are costly and difficult to change. Another concern is that managers today still do not know how to incorporate social responsibility into their daily decisions. To design and implement a successful green supply chain it is vital to make employees understand the concept and to train and development in this project. Firms function as an issue if organizations act with a mindset of environment versus profit. The most important issue created externally would be the poor or bad supplier relationship.

Standards, first step for someone new to the green supply chain topic is to understand which standard(s) or rules apply. This provides organizational direction and is a necessary first step. Awareness, green awareness is improving but has been a challenge particularly in Africa. Business Case Development, Corporate social responsibility, competitive pressures, as well as where to use limited capital will be a choke point for
multi-national supply chains in the future. Sustainability Program Implementation is a challenge because organizations do not know which rules or standards to follow. Communications planning, organizations have to develop a communication strategy early in Green Supply Chain planning process. The communications strategy is keep to driving long term compliance and reducing emission.

Another challenges have also been identified in implementing green supply chain as there is not enough awareness about the green supply chain, often consumers and producers are not aware of what to do to heal the environment or they are ignorant to the fact that they are harming the environment also in some cases high temperature also affect the sustainability of the pipelines, low level of technology that companies fail to adopt the best computer system that can help to track any disruption happen in the pipeline so as to reduce the effects of destroying environment. Also procuring high velocity crude oil causes machine breakdown that fail to manage to pump oil and also if there is high temperature can cause high pressure that can burst the pipe (Murray, 2008).

Oil marketing firms have an impact on the environment during their supply chain processes. This impact has a price that every corporation pays inform of environmental costs (United Nations Division for Sustainable Development Report, 2001) though the traditional structure of cost accounting docs not account for these costs. If companies can develop a GSC that is cost effective in terms of saving money by not having to dispose of harmful by products, it would promote a reduction in obsolescence, decrease
in the amount of money spent on scrap and the resources spent on adhering to regulatory issues.

Green supply chain, in addition to unit production costs, considers environmental cost and its impact on other supply chain process, to the environment and the society. Traditional structure of cost accounting does not count these costs, for instance the costs that oil marketing firms incur to clean up hazardous wastes and oil spills could be classified as contingent costs however any future spills trigger image/relationship costs and external costs due to damage to the nearby aquatic ecosystem. Green supply chain aims at saving these environmental costs.

Environmental costs comprise both internal and external costs and relate to all costs incurred in relation to environmental damage and protection. Environmental costs include conventional costs, hidden costs, contingent costs, image or relationship costs, social costs and health costs. Social and External costs are costs that impact upon the environment and do not directly accrue to the business or the business does not account for, e.g., the damage caused by oil spills to the nearby aquatic system, climate risk leading to global warming while health costs are costs associated with sickness as a result of pollution and global warming (United states environmental protection agency report, 1995).

---

18 United states environmental protection agency report, 1995
Vandalism, According to Black’s Law Dictionary, it is defined as an intentional and malicious destruction of or damage to the property of another, because this poses a threat to society, it is deemed a statutory offense and a crime. The combined effect of this definition would make us arrive in terms of oil as to the effect that Pipeline Vandalism is the illegal act of puncturing or destroying oil pipelines, gas pipelines, petroleum products pipeline, steam pipelines and water pipelines to steal petroleum products, obstruct distribution for personal use, sales on black market or process in illegal refineries.21

According to (Ekenedirichukwu, 2010) in their work they posited that “Pipeline vandalism occurs when buried pipes are exposed and punctured unlawfully for the purpose of siphoning the content flowing through the pipelines. A pipeline may however, rupture due to such natural causes and wear and tear mainly from corrosion. Oil pipeline vandalism has human, economic and environmental implications for the nation. It involves loss of lives and piles up more environmental damage. It causes a nation to incur financial losses and aggravates the vicious circle of poverty. In addition, these implications have multiplier and linkage effects as a vandalized pipeline in one part of the country may cause product scarcity in several parts of the country.22

The Niger Delta region is undergoing a face of catastrophe with a thunderstorm of environmental degradation. Despite the increasing awareness about the needs for

22Poverty and Unemployment: Its Implications for Pipeline vandalization in Nigeria, Nigerian Sociological Review, Vol.2 No.1
protecting environment, environmental degradation already cut a swath through the region quite fast since the inception of oil in commercial quantities in the region. Pipelines vandalism contributes to the environmental pollution often associated with oil spillage. As the vandals bust oil pipelines, a large quantity of crude oil spills on the land surface and consequently degrades the environment. This ultimately impoverishes the people as it destroys the arable land, vegetation, the bio-diversity as well as aquatic lives which constitute the main sources of the economic survival of the people. The region is faced with myriads of environmental problems and diverse socio-economic constraints that are making life unbearable for the people of the region (Jefferey, 2012)

Poor technology and infrastructure system is also one of challenges whereby the most of pipeline companies failed to adopt the use of wireless sensor network which is used to trace the oil movement and pipeline condition and alert just in case there are any leakages or explosions. Weak communication system and infrastructure system whereby most of the roads especially in remote areas in Nigeria are bad that is difficult to pass by faster while going to solve any leakage or explosion. Network system is weak also which affect communication among the pipeline company staff. Also technology in terms of controlling the operations that are being conducted at the oil pipeline stations there are no strong computerized system that can help to detect any machine break down. Many of these explosions can be traced to human error in one way or another and they include but not limited to; Improper installation, including poor welding and failure

---

23The unending plague of oil pipeline vandalization in Nigeria and its attendant effects; fashioning olasting solution, By Kaudeoyomide, 2017
to engage competent personnel, Mechanical damage during excavation work, defective parts of the pipelines still being utilized lapses in maintenance of the pipelines. Additional factors that can cause a pipeline accident include, Poor maintenance of pipes, joints, and valves, Metal fatigue, Corrosion, Mechanical damages, such as dents, Improper repair welds, Defective products, Damage caused by chemicals, Violations of applicable codes, Inadequate safety.24

After the natural gas compression exploiting the aggregates used in compressor stations the temperature of the transported gas increases. The cooled gas leaves the compressor station with temperature around 30°C. This value is not a constant for the entire length of the pipeline between the compressor stations, but after a certain distance it decreases. The gas temperature affects the environment, pressure losses during transport, maintenance of the pipeline insulation and soil fertility. The soil temperature affects also the physical, chemical, physico-chemical reactions in the soil, soil moisture and its viscosity25

If the soil temperature drops below 9°C or rises above 50°C, such conditions lead to the lower soil fertility, the heat transfer between the gas through the pipeline and the environment involves these basic modes, Convection between the gas and wall of the pipe, Conduction of heat in the layers of the wall pipe, Heat conduction in soil, Convection between the surface of the soil and air, Radiation. An important issue in the

---

25 Myers, N. (2005), The Environmental Dimension to Security Issues, The Environmentalist, Volume 6, Number 4, 251-257
analysis of heat transfer is that which of the above methods is essential and which are negligible. The importance of this issue is not only the accuracy of the model of transmission, but in the ways of handling input and output variables. If the temperature increases above 30 centigrade it increases the pressure in the pipe and might cause explosion of the pipe practices.26

2.4 Conceptual framework

Independent variables

- Vandalism
- High velocity
- Crude oil
- Weather
- Costs
- Technology

Control measures

- Efficiency Green
- Pipeline Supply Chain
- Management Practices

Dependent variable

Effects on Pipeline

- Leakage
- Explosion

Source: Researcher’s view

26The unending plague of oil pipeline vandalization in nigeria and its attendant effects; fashioning olasting solution, By Kaudeoyomide, 2018
Figure 2.1 above describes the relationship between variables of the study. The model explains the conceptual framework by showing the assumptions on how the study assumes the influencing-influenced relationship between variables. The framework connotes that the action or influence commences from the point of dependent variable denoted by efficiency Green Supply Chain that due to the issues like vandalism, cost, weather, high velocity crude oil and technology are ones that affects the efficiency practices of green pipeline supply due to the fact that the more they occur the rate of leakage and explosion of pipes increase and hence lead to environmental destructions.
CHAPTER THREE

RESEARCH METHODOLOGY

This chapter was set to state the area, designed for the study investigated, sample size and sampling methods and procedures, source of data and collection methods and data processing and analysis.

3.1 Study Area

The study was conducted at TAZAMA Pipelines Limited, in its Dar es Salaam office located at Tungi Area, Kigamboni. TAZAMA selected as it is transporting crude oil or its petroleum products from the port of Dar-es-Salaam into landlocked Zambia where by its most likely to examine the Efficiency of Green Supply Chain Management. Furthermore, TAZAMA owns, operates and maintains a crude oil pipeline from the port of Dar-es-Salaam to INDENI Refinery in Ndola covering a total distance of 1,710km. Also it included some of the villages that were affected by the leakages and explosion of TAZAMA pipeline and the government side.

3.2 Research Design

This study employed case study designed in order to gain rich understanding of the context of the research and look at the object studied as a whole. Furthermore, staff members specifically from Administration, Operation, and Engineering and Procurement departments were considered as the unit of analysis of the study. Also NEMC on government side and selected village households, with case study it was easy
to organize and evaluate data, as well as synthesizing ideas. The design also helped the researcher to produce accurate representation of the targeted population.

3.3 Sample and Sampling Procedures

Sampling frame of the investigation consisted 65 respondents where by 40 were workers from various departments of TAZAMA which were Administration, Operation, Engineering, Accounting and Procurement. 10 were workers from National Environment and Management Council NEMC.

3.3.2 Sample Size

The investigation used a sample of 65 respondents out of the population of 214 employees of TAZAMA from Administration, Operation, Engineering and Procurement departments. The sample was reasonable due to the fact that it consisted of more than a half of all employees under aforementioned departments, thus it was likely to provide the clear generalization of the matters pertaining to the Practices and Performance of Green Supply Chain Management at TAZAMA. The following table gave out a proper distribution of the respondents from their respective departments.
Table 3.1: Distribution of Respondents in Department

<table>
<thead>
<tr>
<th>Respondent</th>
<th>No. of population</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAZAMA administration department</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>Operation department (TAZAMA)</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Engineering department (TAZAMA)</td>
<td>45</td>
<td>25</td>
</tr>
<tr>
<td>Procurement department (TAZAMA)</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>90</strong></td>
<td><strong>65</strong></td>
</tr>
</tbody>
</table>

*Source: Field Work, 2019*

3.3.4 Sampling Techniques

The study adapted the following sampling techniques.

3.3.4.1 Systematic Sampling

Systematic sampling method was used to obtain 30 respondents from engineering department and 25 from operation department of TAZAMA pipeline Ltd for data generation. Systematic sampling was fairly easy to do and it was widely used for its convenience, time efficiency and provides more precise estimates.

3.3.4.2 Purposive Sampling

Purposive sampling method was used to obtain 10 respondents. The respondents were purposely selected to gain richer understanding of the matter. Those 10 respondents were consulted for data gathering due to the fact that they were likely to give the best picture on the Performance of Green Supply Chain Management at TAZAMA including laws, regulations and policies granted by the Government.
3.4 Source of Data and Collection Methods

This investigation used both primary and secondary data. Primary data was collected though questionnaire and interviews. Secondary data was gathered from documented and published sources including Internet, government reports and journals.

Interview used to collect first-hand information; it was conducted to obtain key information. The interview was also conducted to explore data and information from 15 respondents, 5 each from administration department, procurement department. Interview was useful as it gave access for first-hand information and it enabled face to face contact with respondents which gave a wider room for the collection of information on the matter at hand.

This study used both open and close ended questionnaires for data collection. Total number of 45 questionnaires was administered to 45 respondents from Operation and Engineering departments at TAZAMA, 20 households at the villages that faced environmental problems caused by TAZAMA pipeline leakage and 5 respondents from NEMC administration department. The use of questionnaires is reasonably easy because it allowed respondents to be free in giving out their views about the subject matter.

3.5 Data Processing and Analysis

The gathered data from both objectives were analyzed and interpreted through qualitative approaches with very little use of quantitative approaches. There were both numerical and non-numerical information, to be presented and analyzed in the form of
verbal explanation, examining, comparison, and contrast of themes basing on the objectives of the study.

Moreover, data analysis started in the study field at the time of data collection open ended questionnaires based on that, the researcher identified the concepts, perceptions, and problems that appeared to help in knowing and understanding the relevant situation on oil green supply chain practices conducted by TAZAMA pipelines. Data were edited and organized after it was collected in the field, and content analysis of the transcription was done manually. This ensured the quality and purity of data. This method allowed the researcher to justify the data collected from the respondents to achieve study on each objectives and answer research questions of the study at hand. The presentation and analysis of findings were involving the use of figures in form of graphs and pie charts, and tables in which responses from respondents was distinguish with the use of percentage in order to find the logic regarding each aspect independently.
CHAPTER FOUR
FINDINGS AND DISCUSSION

4.1 Introduction
This chapter is set to give the findings of the study. The study aimed to seek for information and opinions from 65 respondents who were systematically selected by the researcher. Unfortunately, 5 questionnaires were not returned by the respondents. Thus, the presentation and discussion of findings will be provided basing on the 60 returned questionnaires. The chapter is divided into two major categories. The first category explains the socio-characteristics of the respondents. Age, sex and educational level of respondents are described in this category. The second category, explains the findings on examining the practices and performance of green supply chain management in oil industry at TAZAMA PIPELINES LIMITED.

4.2: Socio-cultural Characteristics of Respondents

Figure 4.1: Age group
4.2.2 Gender

The researcher was able to reach both male and female respondents. Male respondents consist of all the respondents which include staff of TPA in Dar es Salaam port and other stakeholders. Female constituted the remained 31.25% of all respondents. The distribution is illustrated with the aid of table 4.2 below.

Figure 4.2: Gender Group

4.3 Educational level

The researcher consulted selected 65 respondent which included staffs from TAZAMA PIPELINE LTD in Dar es Salaam where by 5 of them didn’t manage to return the questionnaire. Respondents with undergraduate degree constituted 62% of all respondents while there were only 13% of respondents with postgraduate level of education and 25% of them where diploma degree level. The distribution is further illustrated with the aid of the table.
4.2.2 Job experience of respondents

The respondents differ in the experience of their work. The questionnaires grouped the working experience into below 2 years with 6 respondents (10%) 2-5 years with 26 (43.3%) respondents, 6-10 years with 15 respondents (25%) and 10 years and above with 13 respondents (21.7%). The following chart shows the job experience of the respondents consulted. The large number of respondents which is 25% and 43% of all respondents implies the existence of experienced workers. However, the higher availability of experienced workers do not contribute much on the performance TAZAMA in ensuring green supply chain of oil as summarized Table 4.1 below.
Table 4.1: Job Experience of Respondents

<table>
<thead>
<tr>
<th>Experience year</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 years and below</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>2-5 years</td>
<td>15</td>
<td>25</td>
</tr>
<tr>
<td>5 – 10</td>
<td>26</td>
<td>43.3</td>
</tr>
<tr>
<td>10 and above</td>
<td>13</td>
<td>21.7</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>60</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

*Source: Field Work, 2019*

4.3: Presentation of findings

This section is aimed at assessing the efficiency of green supply chain of oil at TAZAMA pipelines Ltd in Tanzania. The findings are analyzed and discussed basing on the objectives of the study which was aiming to examine the efficiency of Green supply chain of oil by analyzing the challenges that TAZAMA pipelines is facing, identifying efforts or initiatives conducted to improve efficiency in green supply chain of oil and suggest solution to improve the green supply chain oil.

4.3.1 Challenges of the green supply chain management on oil industry at TAZAMA Pipelines Limited

This question has been answered by three type of sub-questions whereby it was categorized on the factors that are contributed by natural factors or environment, factor
caused by TAZAMA management and vandalism which is contributed by the people living around the pipeline area.

A. Challenges which are contributed by environmental factor

The study identifies 46.6% of the respondents identified that acidic soil as one of the main factor that contribute to corrosion of pipes most of them explains that the acidic content in the soil tend after getting contact with the pipes tends to weaken the pipe walls and simplifies for any other external force to destroy the pump and cause cracks or burst easily if the crude oil pressure is high. Also temperature was 33.3% of 20 respondents whereby it was reported that if the temperature is high it easily increase the pressure of crude oil and the pipe can easily burst and affect the environment. One of respondents said this during interview,

"especially in coastal regions the temperature is high that ranges from 20 to 37 that is very dangerous because it weakens the wrapping materials that can easily cause leakages and fractures to the pipes and even lead to bursting of the pipe like what happened in Idetelo village on 2013, (operating engineer 44, TAZAMA pipelines ltd)’’.

Also other 20 respondents which is like 33.3% of all respondents reported that rainfall is also contribute in destruction of TAZAMA pipeline infrastructure where by rainfall contribute much on soil erosion whereby it increase pipe exposure and other people easily try to break the pipes to steal crude oil, also it has been reported that rainfall destroys the infrastructure like roads and railways that is difficult to access during rain
seasons and that rainfall plays a big role in spreading of spilled crude oil to water resources and cause environmental destruction.

The study conducted by (Walley, 2014) in Nigeria also addressed that the acidic soil is one of the main factors that affects the pipes, whereby they weaken the pipes through chemical reaction which pave a way for other physical erosion and it contributed at large in influencing vandalism especially in village areas.

From the researchers opinion, it is better for oil transporting industries to conduct soil testing so as to determine the level of acid in it and to what extent does the chemical reaction will affect the pipeline and cause bursting or leakage. Table 4.2-below illustrates the findings from the challenges which are contributed by environmental factor.

**Table 4.2: Challenges which are contributed by environmental factor**

<table>
<thead>
<tr>
<th>Natural factor</th>
<th>Respondents frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rainfall</td>
<td>20</td>
<td>3.3</td>
</tr>
<tr>
<td>Temperature</td>
<td>12</td>
<td>20</td>
</tr>
<tr>
<td>Acidic soil</td>
<td>28</td>
<td>46.7</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>60</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

*Source: Field Work, 2019*

**B. Factors contributed by TAZAMA management during green supply chain.**

High maintenance, spare parts and equipment and repairing cost on green supply chain of oil have been reported by 32 respondents which is 53.3% whereby it has been
difficult for TAZAMA pipeline to adopt fully Green supply chain of oil due to the fact that it is very expensive that the organization itself cannot afford which included cost of machines, cost of software and communication facilities. One respondent also reported that during the interview that,

“most of facilities used now are aged for example machines and they need to be changed and replaced and introduce new computerized system which can easily trace the areas with any leakages or fractures whereby the problem can be solved easily than doing it manually, female operator 47 at TAZAMA headquarters.”

Also 18 respondents which is 30% of respondents has reported that insufficient knowledge, training and seminars on Green supply chain to TAZAMA staffs so that they can be aware on Green supply chain of oil mostly where by 66.7% of respondents at TAZAMA pipelines in Dar es Salaam didn’t know what is Green supply chain especially in oil industry. Also 16.7% of respondents which is 10 respondents reported that both Green supply chain cost is high, insufficient knowledge and training to TAZAMA pipeline Limited’s staff.

Findings from the study conducted by (Ekenedirichukwu, 2010) in Niger address that cost of materials including coating materials and operating Green Supply chain management is high that is difficult for companies to adopt Green Supply chain in Oil industry. which from my opinion this is the main reason for most of oil transporting companies to fail to practise green supply chain of oil they are fearing the cost of equipment especially coating materials.
Table 4.3: Factors caused by TAZAMA Management

<table>
<thead>
<tr>
<th>Factors</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green supply chain cost</td>
<td>32</td>
<td>53.3</td>
</tr>
<tr>
<td>Knowledge, training and seminars to TAZAMA</td>
<td>18</td>
<td>30</td>
</tr>
<tr>
<td>pipelines staffs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Both green supply chain cost, training, seminars</td>
<td>10</td>
<td>16.7</td>
</tr>
<tr>
<td>and knowledge. Factor</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>60</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Source: Field Work, 2019

C. Vandalism by households on TAZAMA pipeline transportation

Poverty have been reported by 40 respondents which is 66.6% of the respondents where by most of the areas that the pipeline have passed are rural areas that most of people are poor and this influence them to steal crude oil and sell crude oil. One of the people interviewed said, ‘people who have low economy they normally sell crude oil so as to earn money goes sustain their life example in Iringa region people steal crude oil and sell to the owners of chain saw machines(male 35,kigamboni,Dar es Salaam).
Security problem was also reported by 10 respondents which is 16.7% where by the security system in rural areas is very poor whereby in most of all rural areas there are no police stations or police patrol which is easily for thieves to break pipes and steal crude oil. also 10 respondents which is also 16.7% has reported that lack of knowledge among households is one of the factors that also contribute to vandalism that most of rural villagers they don’t know that what are the consequences of doing vandalism they just do it for the sake of getting money only that.

The study conducted by (Diabat, Govindan, 2011) in Nigeria also address that the main cause of vandalism is poverty that most of the people are poor and decide piercing the pipes so that they can get oil and sell it to the users.

Table 4.4: Table Representation of vandalism on green supply chain of oil industry at TAZAMA.

<table>
<thead>
<tr>
<th>Factors</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poverty</td>
<td>40</td>
<td>66.6</td>
</tr>
<tr>
<td>Security problem</td>
<td>10</td>
<td>16.7</td>
</tr>
<tr>
<td>Poverty</td>
<td>10</td>
<td>16.7</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>60</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

*Source: Field Work, 2019*
4.4 Initiatives conducted by various private and public sectors on Green Supply Chain on oil industry at TAZAMA pipelines Limited.

On ensuring the green supply chain it has to include different sectors private and public sectors causes TAZAMA as her will not manage to implement effective Green supply chain. Where by 56.7% of the respondents which represents 34 respondents reported that TAZAMA pipelines limited have performed a lot of environmental measures on Green supply chain including the training to workers and villagers on public relation functions which is integral on dissemination of environmental issues especially pipeline security and right of the way (ROW) protection, also the company is planting trees and glasses on the affected areas and also the do compensate especially on those areas which has been affected normally with eruption or any other environmental destruction conducted after leakage or eruption.

Also 24% of respondents (24 respondents) have reported that the government have done also a lot of efforts in collaboration with TAZAMA by improving the police force and increase patrols, also there are policies and laws that were granted by the Tanzania parliament whereby if someone perform any vandalism activities he or she will be charged as one who has sabotage economy of Tanzania and went direct to jail. 3.3% (2 respondents) said that during interview,””

\textit{African Development Bank and World Bank have been instrumental on providing projects financing for rehabilitating tanks, pipes with a view of reducing pollution. (Female 49, Kigamboni Dar es Salaam)}””
The study also matches with the findings by (Ambichije, 2011) whereby the study was conducted in Kenya and found out that there is poor support from the government to help and improve the green supply chain practices where by most of companies incur cost in dealing restoring destroyed environment and fighting against vandalism.

Table 4.5: Efforts conducted by different sectors to improve GSCM

<table>
<thead>
<tr>
<th>Role played by</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAZAMA</td>
<td>34</td>
<td>56.7</td>
</tr>
<tr>
<td>Public sectors</td>
<td>24</td>
<td>40</td>
</tr>
<tr>
<td>Private sectors</td>
<td>2</td>
<td>3.3</td>
</tr>
</tbody>
</table>

TOTAL 60 100

Source: Field Work, 2019

4.5 Alternative solution to the challenges facing the Green Supply Chain Management practices so as to revamp its performance in TAZAMA Pipelines Limited.

From the data collected each respondent have provided the recommendations concerning the each objective on how to address challenges and how to improve Green Supply Chain of oil industry especially at TAZAMA pipelines ltd.
4.5.1 Suggested solutions concerning the challenges facing green supply chain of oil industry in TAZAMA Pipelines.

D. Concerning the challenges caused by natural factor.

In overcoming the challenge of natural factors which including temperature, acidic soil and rainfall where by 60% of the (36) respondents suggested that the budget on protection materials of the pipe where by one respondent suggested this during interview,

‘‘at TAZAMA pipelines ltd uses catholic protection but it has to make sure that the materials are available any time and at the required amount so as if any repairing needed is done immediately so to avoid effects on environment and reduce loss of oil, male operator 40 at TAZAMA ltd ’’. Also 30% of the respondent They suggested that the company to increase planting trees and glasses especially to the areas with higher erosion and high rainfall so as to overcome the problems that caused by rainfall including soil erosion and also they advised Government to improve the road, railway and bridges infrastructure so that it can be easy for the TAZAMA operation team to reach those affected areas on time and manage to reduce the rate of environmental destruction. And 10% they suggested that both measures should be taken improve infrastructure by the government, plant trees and grasses and for TAZAMA management to increase the budget of protection materials for them to become sufficient. Below is illustration presentation.
Findings match with the study conducted by (Walmart, 2012) that both private and government sector should increase focus on environmental conservation by planting trees and glasses and soil treatment.

Table 4.6: Suggestion on solving the challenge caused by natural factors.

<table>
<thead>
<tr>
<th>Suggested solutions</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase budget for protection materials.</td>
<td>36</td>
<td>60</td>
</tr>
<tr>
<td>Planting trees &amp; grasses and improving road, railway,</td>
<td>18</td>
<td>30</td>
</tr>
<tr>
<td>bridges and communication system on rural areas for easy accessibility</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Both including planting trees and grasses, TAZAMA</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>pipelines to increase the budget on protection materials</td>
<td></td>
<td></td>
</tr>
<tr>
<td>and government to improve infrastructure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>60</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Field Work, 2019

E. Suggestions to TAZAMA management

To TAZAMA pipelines management the 70% of respondents suggested that the management should increase more trainings and capacity building programs to their workers concerning Green supply chain on oil industry this will help to increase awareness and reduce vandalism that people will understand the consequences. Also 30% of the respondents they suggested that procurement department should procure materials on time and make sure that when procuring crude oil there must be exactly specification conformation to avoid procuring crude oil with high density that will cause
machines breakdown and also the management should shift from old system to computerized system so that they can trace any spillage or fractures before any further damages.

Table 4.7: Suggestions to TAZAMA management

<table>
<thead>
<tr>
<th>Suggestions</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trainings and capacity building to staff</td>
<td>42</td>
<td>70</td>
</tr>
<tr>
<td>Procuring right crude oil according to specification &amp; shift to computerized systems.</td>
<td>18</td>
<td>30</td>
</tr>
<tr>
<td><strong>TOTA</strong></td>
<td><strong>60</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

*Source: Field Work, 2019*

**F. Suggestions towards dealing with vandalism**

To overcome the problem of vandalism conducted by the people around the TAZAMA pipeline where by 70% of the respondents suggested that TAZAMA pipeline ltd to provide seminars with people living around the pipeline areas about keeping environment safe and effects of vandalism as well as the consequences of it. Also 25% of the respondents have suggested that government should increase security and patrol to help catching people who perform vandalism, 5% of the respondents suggested that TAZAMA Pipeline should use the computerized system to trace any vandalism immediately and fix the damage immediately before it has bring out consequences to the people living around.
The study which matches with these findings conducted by (Bertolin, 2013) suggested that training and capacity building is the best method to be applied while dealing with vandalism cause using security officers is difficult due to the remoteness of the areas in Nigeria.

**Table 4.8: Diagram of suggested ways to overcome vandalism**

<table>
<thead>
<tr>
<th>Suggested ways</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training and seminars to people living around the pipeline</td>
<td>42</td>
<td>70</td>
</tr>
<tr>
<td>Government to increase more security</td>
<td>15</td>
<td>25</td>
</tr>
<tr>
<td>TAZAMA Pipelines Ltd start using computerized system</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>60</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Source: Field Work, 2019

**4.5.2 Initiatives towards improving Green supply chain of oil by TAZAMA Pipelines Ltd.**

48.3% of the respondents (29 respondents) suggested that Government should improve infrastructure including road, railways and bridges so that rural areas should be easily accessed during rainy season that can simplify the process of fixing problems of leakages so as it cannot provide a lot of loss to the environment and company. 25% of respondents suggested that TAZAMA pipeline ltd should also increase a lot of training
to staff on Green supply chain management on oil industry also 16.7% respondents suggested that TAZAMA should increase budget on purchasing the spillage equipment, 3% of respondents suggested that TAZAMA pipeline should use drones and choppers on patrol and maintaining the destroyed pipes.

Also in a study conducted by (Walmart, 2012), suggested that the companies should increase the budget on green supply chain management so that they can manage purchase environmental friendly machines and equipment so as to reduce effects on environment caused by oil supply Chain.

Table 4.9: Initiatives to improve Green supply chain in oil industry at TAZAMA pipeline Limited

<table>
<thead>
<tr>
<th>Initiatives to improve in Green supply chain</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government to improve infrastructure including roads, railway, bridges</td>
<td>29</td>
<td>48.3</td>
</tr>
<tr>
<td>TAZAMA pipeline should increase training to staff on Green supply chain</td>
<td>18</td>
<td>30</td>
</tr>
<tr>
<td>TAZAMA ltd increase budget on spillage materials</td>
<td>10</td>
<td>16.7</td>
</tr>
<tr>
<td>Use of drones and choppers on patrol and maintenance of pipes by TAZAMA Pipelines Limited</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>60</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

*Source: Field Work, 2019*
CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.0 Introduction

This chapter presents a conclusions and recommendation on examining the efficiency of green supply chain management in oil industry in Tanzania. Whereby the study had three specific objectives.

i. To determine the challenges of the green supply chain management that hinders the performance of TAZAMA Pipelines Limited

ii. To examine the initiatives from various actors towards improving green supply chain management of TAZAMA pipelines.

iii. To identify alternative solution to the challenges facing the green supply chain management practices so as to revamp its performance in TAZAMA Pipelines Limited.

5.1 Conclusion

An analysis and interpretation of data in the current study revealed a number of findings, which could be summarized as follows;
5.1.1 Challenges of the green supply chain management that hinders the Performance of TAZAMA Pipelines Limited.

The main challenge that is facing Green supply chain of oil at TAZAMA pipeline ltd is categorized in three categories which are the challenges caused environmental factors, management and caused by people living around pipeline.

Challenges caused by natural factors or environmental factors, the study found out acidic soil is one of the major challenge facing pipeline supply chain where by 46.6% of the respondents that the acidic nature of soil if come into contact with pipes they weaken the pipes and simplifies the leakages or breakage of the pipe.

For the challenges faced or contributed by TAZAMA pipelines management 53.3% addressed that cost is the main problem where by green supply chain of oil industry requires a lot of materials like protection coating materials which include high performance fusion bonded epoxy, copolymer adhesive outer layer of pipe called polyethylene so the budget is not sufficient.

Challenges caused by people living around pipeline is vandalism where by 66.6% of respondents addressed that is caused by poverty that is existing in most of these areas.

5.1.2 Initiatives from various actors towards improving green Supply Chain Management of TAZAMA Pipelines.

The main initiative that is being performed by TAZAMA Pipelines is addressed by 56.7% by planting trees and grasses to the areas affected by leakage and spillage of
crude oil and also do compensation to those affected areas. They are less effort conducted by the government and private sectors.

5.1.3 Alternative solution to the challenges facing the green supply chain management practices so as to improve its performance in TAZAMA Pipelines Limited.

For TAZAMA pipelines ltd management have 70% of the respondents suggested that it should increase training and seminars to the households concerning the effects of vandalism, also 48.3% of the respondents addressed the government to improve infrastructure so as to simplify movement of technicians in case of patrol and maintenance to avoid delay especially during rainy season.

5.2 Recommendations

From the research findings, the following recommendations can be done so as to improve green supply chain of oil at TAZAMA pipelines whereby they are categorized according to the department available at TAZAMA pipelines ltd and also for government and private sectors so as each part should play its role to improve efficiency on green supply chain of oil at TAZAMA pipelines limited.

5.2.1 Procurement department

i) The procuring department must make sure that they procure crude oil which conforms to the required specifications to avoid machine breakdown, pipe fractures and bursting of the pipe this will help to reduce cost of maintenance and operation cost.
ii) Also procuring team must use some procuring techniques for the sake of reducing procuring costs like bulk purchases also purchasing from various suppliers with reasonable price this will the TAZAMA pipelines management to minimize cost on GSCM.

iii) To make sure that coating materials, magnesium materials and PIG materials are delivered on time to solve the problem of delaying of equipment that affects the performance of the operation team in terms of fixing the leakage or bursting of the pipes.

iv) To perform green procurement not only on supply chain but in other materials that are procured by the organization so as to help to reduce a lot of pollutions that may be caused by non-environmental friendly materials.

5.2.2 Operations department

i) Making sure that they reach the affected areas early to avoid more loss or environmental destruction that if they manage to arrive on time the rate of spillage will be low and area affected will also be small as well as reducing loss to the company.

ii) Should manage to provide betters specifications of equipment, spare parts and machines to avoid breakdowns and delays that should help procuring department in procurement of materials so as to reduce organization cost and also delay in operations.
5.2.3 TAZAMA Management

i) To provide special seminars or capacity building program to people living along the pipeline about the negative effects of vandalism to their health, environment and consequences after being sued, should make them understand that protecting the pipeline is like protecting the national source of income.

ii) Provide support to the societies like building hospitals, schools, water services and other way of supporting the society to make them feel they are part of the project that they have to protect it.

iii) To establish the public relation department that will deal with maintaining the relationship between the people along the pipelines and TAZAMA Pipeline ltd, will be dealing with providing capacity building programs, seminars and training, so as to maintain good relationship also to get public help on protecting the pipe and finding the thieves also in dissemination of environmental issues especially pipeline security and Right of Way (ROW) protection.

iv) To prepare a training programs for the TAZAMA pipeline staffs on Green supply chain management, that they should know what is Green supply chain management on oil industry and what are the benefits of applying Green supply chain knowledge to the oil industry through this it will help them to use that knowledge on their daily performance.

v) Increase planting on trees and grasses so as to protect the environment not only on the affected areas but also other areas because other areas are affected by rainfall also so is better to proactive.
vi) Increase the procurement budget on protection coating materials so that they can be available at any time just in case for any emergency the problem will be fixed immediately and reduce the rate of loss on environment and also to the company.

vii) Changing the system of supply chain from manual to computerized system so that to detect faults like bursting, leakages easily and to manage to control it to avoid further loss.

viii) Provide research and development department that will be conducting different researches and information collected will help on detecting problems and plan on ways to overcome them before they occur also through research will help to provide many answers and solution on challenges facing Green supply chain of oil at TAZAMA Pipelines Ltd.

5.2.4 Government

i) Government should burn the business of crude oil and to introduce the law which hinder all vandalizes from selling crude oil.

ii) Should improve the infrastructure and communication system so as to simplify the transportation and communication during green supply chain of oil operations to avoid or mitigate loss and increase efficiency at TAZAMA pipelines Ltd

iii) To support TAZAMA pipelines on planting trees and grasses along the pipe and also influence people to take care of those plants so as to have a safer environment.

iv) To improve security and patrol around the pipeline area and make sure that all cases are being judged on time and used as an example to others.
v) There must Compliance of laws by legislature concerning oil transportation and policies that are made by TAZAMA board of directors.

5.2.5 Private sectors

i) To help TAZAMA pipelines Ltd on environmental reclamation on planting trees and grasses so as to reform the destroyed land, this will reduce burden to TAZAMA.

ii) Providing seminars on protecting environment to villagers so they become aware of what is supposed to be done to help in protecting environment through fighting against vandalism.

iii) Conduct research and come up with different alternatives on addressing different challenges that TAZAMA pipeline ltd is facing towards Green supply chain especially on oil industry.

4.3 Conclusion

Green supply chain practices in oil industry in Tanzania is the one important that helps to protect environment and reduce effects that may cause an environmental destruction or disasters, reduce cost on environmental reclamation like planting trees, also it influence environmental sustainability but the GSCM practises in oil industry are supposed to be conducted by both parties not TAZAMA pipelines only but also government and private sectors should engage in helping TAZAMA pipelines Ltd.
REFERENCES


Dyer, W., Lee, J. & Sang, M. (2000); *Green Supply Chain Management*
Department, University of Nebraska USA


Green Supply Chain Forum (2008). *Sustainable Development and Business Practices Forum*: Tianjin, China


Hoffman D. L & Novak T. P (1999); *Measuring the Customer Experience in Online Environments*: A structural Modeling Approach, Owen Graduate School of Management, Vanderbilt University


Kainuma, N. T. (2006); *Mult-attribute utility theory to lean and Green Supply Management*


APPENDICES

APPENDIX I: RESEARCHERS INTRODUCTION INFORMATION.

Your time is highly valuable, so the researcher have made all feasible efforts to develop a questionnaire that is as short as possible.

All the information you will provide in the following questionnaire will remain strictly CONFIDENTIAL. Your company will not be identified as all questionnaires will be coded upon receipt so that no links are possible between the data collected and the identity of your company.

The questionnaire is divided into FOUR sections:
Section I: Researchers Introduction Information.
Section II: Person Information.
Section III: Questionnaire to Management Team on Company General Information.
Section IV: Research Questions.

It is important that you answer all questions pertaining to your company taking into consideration the following:

i. Instructions/guidelines are provided throughout the questionnaire;

ii. If you do not know the precise answer to some questions, please answer to the best of your knowledge. Approximations will be more useful to this study than no answer at all; and,

iii. If you have any question or concerns, please call the following
   Mobile number 0713336990
   E-mail- specymkami@yahoo.co.uk

“THANK YOU FOR YOUR TIME.
APPENDIX II: PERSONAL INFORMATION

2.1 Gender (Tick the applicable)

a) Male.
   
   b) Female.

2.2 In what age group do you belong? (Tick the applicable)

a) Below 20 years.
   
   b) Between (20-40) years.
   
   c) Above 40 years.

2.3 In which level of Education do you belong? (Tick the applicable)

a) Primary Education.
   
   b) Secondary Education.
   
   c) Diploma or Equivalent.
   
   d) Degree or Equivalent.
   
   e) Masters/PhD Degree.

2.4 How long have you worked in this Institution? (Tick the applicable)

a) 0-1 year.
   
   b) 2-5 years.
   
   c) 6-10 years.
   
   d) More than 10 years.

“THANK YOU FOR YOUR TIME
APPENDIX III: QUESTIONNAIRE TO MANAGEMENT TEAM: COMPANY'S

3.1 SECTION A: General information.

i. What is the correct business legal status of your Company/Institution (*Tick the applicable*)

   a) Private Profit Making Limited Company
   b) Private Non-profit Making.
   c) Government Institution.
   d) Don’t know.
   e) Other (Mention it)………………………………………………………………..
      ………………………………………………………………….

ii. In which year was your company founded

<table>
<thead>
<tr>
<th>YEAR</th>
<th>DON’T KNOW</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

iii. How was your Company established (*Tick the applicable*)

   a) Private Profit Making Limited Company.
   b) Private Non-profit Making.
   c) Privatization of State-owned Firm.
   d) Sole Proprietorship.
   e) Private Subsidiary of Formerly State Owned Firm.
   f) Commercial Trust.
   g) Charity Firm.
h) Joint Venture Firm (Local).

i) Joint Venture Firm (Location & Foreign Firm)

j) Other
   (Specify)...................................................................................................................
   ........................................................................................................................................

3.2 QUESTION 2:

How would you best desirable your company’s main areas of activity? *(Tick one only)*

a) Manufacturing.

b) Transport

c) Agriculture, Hunting and Forestry.

d) Mining of Quarrying.

e) Health and Social Works.

f) Construction.

g) Fishing.

h) Financial Intermediation.

i) Education.

j) Public Administration.

k) Defence of Social Security.

l) Whole sale & Retail Trade.

m) Read Estate.

n) Electricity & Gas.
3.3 QUESTION 3:

How many full time employees and causal staff in total work in your company/institution (*Tick the applicable range*)

<table>
<thead>
<tr>
<th>RANGE</th>
<th>FULL TIME</th>
<th>CAUSAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5-9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-49</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50-99</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100-499</td>
<td></td>
<td></td>
</tr>
<tr>
<td>500 or more</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Don’t know</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3.4 QUESTION 4:

Which of the following best describe the control of your company? Control means making day-to-day decision concerning operational issues of your company (Tick one only).

a) Individual Owner of the Company.

b) Family Member.

c) Shareholders.

d) Executive Committee.

e) C.E.O.

f) Board of Director.

g) Management Team.

h) Workers Council.

i) Government Agency/Authority.

j) Foreign Company.

k) Don’t Know.

l) Do not exist.

m) Other (Specify).

……………………………………………………………………………………

……………………………………………………………………………………

……………………………………………………………………………………

……………………………………………………………………………………

……………………………………………………………………………………

……………………………………………………………………………………

……………………………………………………………………………………

……………………………………………………………………………………

……………………………………………………………………………………

……………………………………………………………………………………
3.5 QUESTION 5:
What is the highest decision making body in your company? (Decision making here refers to strategic and long-term decision) (Tick the Applicable)

a) Shareholders Meeting (AGM).

b) President/ Chairman of the Company.

c) Major Shareholders.

d) Board of Directors.

e) Professional Management.

f) Workers Council.

g) Do not exist.

h) Do not know.

i) Other (Specify)

……………………………………………………………………………………
……………………………………………………………………………………
……………………………………………………………………………………

APPENDIX IV: RESEARCH QUESTIONS

SECTION A: General interview questions

4.1 Do you have any knowledge on how Green supply chain is managed? (Tick the applicable)

a) Yes

b) No
If yes, please explain your knowledge in Green supply chain management.

4.2 What are the challenges associated with Green supply chain Management in your institution on daily routine? (*Tick the applicable*)

a) Weather
b) Acidic soil
c) Vandalism
d) Incorrect supplied crude oil.
e) All of the above.

4.3 How do the challenges affect the implementation of the Green supply chain Management? (*Tick the applicable*)

a) Moderate.
b) Bad.
c) Very good.
d) Worse.

4.4 How do you handle the challenges you face in Green supply chain management execution?...
4.5 Are you aware of the areas which are likely to have challenges on Green supply chain management in your Institution? (*Tick the applicable*)

a) Yes. [ ]

b) No. [ ]

If yes, please mention them:

…………………………………………………………………………………………...
…………………………………………………………………………………………...
…………………………………………………………………………………………...

4.6 From which part of the Green supply chain Management implementers mainly arise the challenges? (*Tick the applicable*)

a) Procuring Entity/ Department. [ ]

b) Supplier. [ ]

c) Transporting management team [ ]

d) Government [ ]

e) Public [ ]

f) Both of them. [ ]

4.7 Explain your answer with a vivid example:

…………………………………………………………………………………………...
…………………………………………………………………………………………...
…………………………………………………………………………………………...
4.8 How the Green procurement Management Challenges managed by your Institution as they arise?


4.9 Is Professionalism and advanced technology applied in the Green supply chain Management activities in your institution? (Tick the applicable)

a) Yes. 

b) No. 

4.10 What has been the result after the measures taken? (Tick the applicable)

a) Excellent. 

b) Very good. 

c) Good. 

d) Fair. 

4.11 Is the measures on Quality control applied on activities to alleviate challenges faced during Green Supply Chain Management? (Tick the applicable)

a) Yes. 

b) No. 

77
4.12 Do you think that, the proposed measures (Quality control) can have positive outcomes towards proper Green supply chain Management? (Tick the applicable)

a) Yes. ☐

b) No. ☐

4.13 Briefly explain your answer above:

…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………

4.14 Do you think technology advancement can reduce environmental problems and improve Green supply chain management?

a) Yes. ☐

b) No. ☐

4.15 Is there any initiative conducted by other private or public sector to help your institution on Green supply chain Management?

a) Yes. ☐

b) No. ☐
4.16 What are the impacts of those initiatives towards improving Green supply chain management on your company?

...........................................................................................................................................
...........................................................................................................................................
...........................................................................................................................................

4.17 Do you attend professional training workshop and seminars on how to deal with green supply chain Management challenges? *(Tick the applicable)*

a) Yes.  

b) No.

4.18 If yes what are the outcomes of knowledge obtained? Briefly explain:

...........................................................................................................................................
...........................................................................................................................................
...........................................................................................................................................
...........................................................................................................................................
Interview Guide Lines

You are requested to tick only ONE number for the answer that best express your opinion in each sentence.

1: Challenges
This section explores your opinion on the facing green supply chain of TAZAMA pipelines

<table>
<thead>
<tr>
<th>Natural Factors</th>
<th>Tick</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Temperature</td>
<td></td>
</tr>
<tr>
<td>2 Rainfall</td>
<td></td>
</tr>
<tr>
<td>3 Acidic soil</td>
<td></td>
</tr>
<tr>
<td>4 Any other natural factor</td>
<td></td>
</tr>
</tbody>
</table>

I: Please explain and provide examples for each of the abovementioned challenges


II: Please provide suggestions for each of the challenges mentioned above


2: Factors faced or caused by management of TAZAMA during green supply chain

<table>
<thead>
<tr>
<th>Factors</th>
<th>Tick</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Knowledge on green supply chain</td>
<td></td>
</tr>
<tr>
<td>2. Cost</td>
<td></td>
</tr>
<tr>
<td>3. Poor maintenance</td>
<td></td>
</tr>
<tr>
<td>4. Lack of training and seminars on Green supply chain</td>
<td></td>
</tr>
<tr>
<td>5. Other reason</td>
<td></td>
</tr>
</tbody>
</table>

I: Please explain and provide examples for each of the abovementioned challenges

II: Please provide suggestions for each of the challenges mentioned above
3: Vandalism by households on TAZAMA pipeline transportations

<table>
<thead>
<tr>
<th>Factors cause vandalism</th>
<th>Tick</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Lack of green supply chain knowledge</td>
<td></td>
</tr>
<tr>
<td>2. Poverty</td>
<td></td>
</tr>
<tr>
<td>3. Poor security system</td>
<td></td>
</tr>
<tr>
<td>4. Other reason</td>
<td></td>
</tr>
</tbody>
</table>

I: Please explain and provide examples for each of the abovementioned challenges

II: Please provide suggestions for each of the challenges mentioned above
4: Technological problem

<table>
<thead>
<tr>
<th>Factors</th>
<th>Tick</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Poor standards</td>
<td></td>
</tr>
<tr>
<td>2. Cost of machines</td>
<td></td>
</tr>
<tr>
<td>3. Weak communication system</td>
<td></td>
</tr>
<tr>
<td>4. Cost of software</td>
<td></td>
</tr>
<tr>
<td>5. Other reason</td>
<td></td>
</tr>
</tbody>
</table>

I: Please explain and provide examples for each of the abovementioned challenges

II: Please provide suggestions for each of the challenges mentioned above
Roles played by different public and private sector to improve GSC on TAZAMA pipelines

5: Role played by government

<table>
<thead>
<tr>
<th>Factors</th>
<th>Tick</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Policy making</td>
<td></td>
</tr>
<tr>
<td>2. Training and seminars to both TAZAMA and societies</td>
<td></td>
</tr>
<tr>
<td>3. Improve security</td>
<td></td>
</tr>
<tr>
<td>4. Other reason</td>
<td></td>
</tr>
</tbody>
</table>

I: Please explain and provide examples for each of the abovementioned challenges

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

II: Please provide suggestions for each of the challenges mentioned above

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

84
### 6: Role played by other sectors

<table>
<thead>
<tr>
<th>Factors</th>
<th>Tick</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Financial support</td>
<td></td>
</tr>
<tr>
<td>2. Research and training to the villagers along pipeline</td>
<td></td>
</tr>
<tr>
<td>3. Environmental reclamation</td>
<td></td>
</tr>
<tr>
<td>4. Others</td>
<td></td>
</tr>
</tbody>
</table>

**I: Please explain and provide examples for each of the abovementioned roles**

**II: Please provide suggestions for each of the roles mentioned above**
7: Role played by TAZAMA PIPELINE towards GSCM

<table>
<thead>
<tr>
<th>Initiatives</th>
<th>Tick</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Training to workers and villagers</td>
<td></td>
</tr>
<tr>
<td>2. Improve technology</td>
<td></td>
</tr>
<tr>
<td>3. Other reasons</td>
<td></td>
</tr>
</tbody>
</table>

Please explain and provide examples of above mentioned factors

Please provide suggestions for each above mentioned factors